

controlling the in-flight cooling of the atomized droplets:

means for directing and depositing the cooled atomized droplets onto a pattern to form the

mold.

35. The system of claim 34 wherein at least one of said plurality of reservoirs contains solid particles, said solid particles being injected into said nozzle flow channel between said inlet and outlet ends and proximate to said flow channel longitudinal axis, said injected solid particles thereby mixing with the injected liquid materials and codeposited onto a pattern to form the mold.

36. Cancelled.

37. Cancelled.

REMARKS

Claims 1-30 have been rejected and an objection to the drawings has been made. Applicant has amended claims 1, 3-4, 18-20 and 34; claims 9-15, 25-31 and 36-37 have been cancelled; and claims 1-8, 16-24 and 32-35 remain in the application. Reexamination and reconsideration of the application are requested.

In response to the Examiner's objection to the drawings, a Substitute Drawing Request is provided herein in which substitute drawing sheet 5 is submitted with the Figs 4A, 4B and 4C correctly labeled. No new matter is contained in the new drawing sheet. Applicant respectfully requests

formal acceptance of the substitute drawing to the file.

Claims 9-15, 25-31, 36 and 37 were objected to under 37 C.F.R. § 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant has cancelled claims 9-15, 25-31, 36 and 37 and it is submitted that this objection can now be withdrawn.

Claims 3, 4, 19 and 20 were rejected under 35 U.S.C. § 112 second paragraph, as being indefinite for improper antecedent basis. In response to this rejection, Applicant has amended claims 3, 4, 19 and 20 as suggested by the Examiner to provide antecedent basis clarity. Accordingly, it is believed that this ground for rejection can be removed.

Claims 1-37 stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Orme et al. in view of Alvarez et al..

Before discussing the rejections based on 35 U.S.C. § 103, it is thought proper to briefly state what is required to uphold such a rejection. The initial burden is on the Examiner to establish a case of *prima facie* obviousness. In order to do this by combining references, the prior art must provide some reason or motivation to make the claimed compositions, *In re Dillon*, 16 U.S.P.Q.2d 1897, 1901 (Fed. Cir. 1990) (en banc). As more recently and aptly stated in *In re Jones*, 21 U.S.P.Q.2d 1941, 1943-44 (Fed. Cir. 1992) (emphasis in original):

Before the PTO may combine the disclosure of two or more prior art references in order to establish *prima facie* obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. . . . Conspicuously missing from this record is any *evidence*, other than the PTO's speculation (if it be called evidence) that one of ordinary skill in the . . . art would have been motivated to make the modifications of the prior art necessary to arrive at the claimed [invention].

When making a rejection under 35 U.S.C. § 103 there are three fundamental areas the Examiner is required, under 37 C.F.R. § 1.106 and MPEP § 706.02, to cover. First, the rejection should set forth

the differences between the claims and the prior art. Second, the proposed modification of the applied references necessary to arrive at the claimed subject matter should be set out. Third, there must be an explanation why such proposed modifications would be obvious. With the above background in mind the rejections under 35 U.S.C. § 103 will be discussed.

The Examiner notes (on page 5) that “Orme et al. does not disclose a nozzle as recited by the instant claims”. However the Examiner further states that it would be obvious “to modify the apparatus of Orme et al. with the nozzle of Alvarez et al. (-853) because the nozzle of Alvarez et al. (-853) would alternatively form droplets and because Orme et al. (360: col. 1, line 56, to col. 2, line 31) discloses that such nozzles are well know in the art”.

Applicant respectfully asserts that the Examiner has not established a *prima facie* case of obviousness and in support of Applicant’s position a Declaration from Dr. McHugh, the inventor of the subject invention, is attached and incorporated herein by reference. Dr. McHugh notes that Orme et al. actually teaches away from the combination of the combination of spray forming technologies with the Orme et al. invention. Dr. McHugh states that Orme et al. has an objective to control the droplet sizes and speed and that this is a shortcoming of spray manufacturing (See: Orme et al. column 2, lines 53-57, lines 60-63, column 4, lines 59-63 and column 8, lines 49-54).

Accordingly, the fact that “the nozzle of Alvarez et al. would alternatively form droplets, and that Orme et al. discloses that such nozzles are known in the art does not support the proposed modification suggested by the Examiner. Rather, Orme et al. actually teaches away from such proposed modification.

Additionally, Dr. McHugh observes that the proposed modification of the Orme et al. apparatus

would destroy the purpose the intended purpose of the Orme et al. of "precisely controlled streams of liquid droplets" (Orme et al. column 4, line 65 through column 5, line 1) and that controlled streams of droplets is a deficiency of spray forming technologies (column 3, lines 53-57).

For the foregoing reasons, it is respectfully asserted that the Examiner has not established a prima facie case of obviousness and it is requested that this ground for rejection be withdraw and the claims found in a condition of allowance.

Minor grammatical amendments have been made to independent claims 1, 18 and 34 to better define the subject invention. No new matter has been added by these amendments.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages are captioned "Version with markings to show changes made".

In view of the above amendment and remarks, Applicants believe this application should be considered ready for allowance and Applicants earnestly solicit an early notice of the same. Should the Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application, please call the undersigned at the below-listed number.

RESPECTFULLY SUBMITTED,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of)
)
Kevin M. McHugh)
)
Serial No. 09/592.003) Examiner: Leyson
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Filed 06/12/00) Group Art Unit: 1722
)
Atty. Dkt.: EGG-PI-612A1a)
)
For: Rapid Solidification)
Processing System for)
Producing Molds, Dies and)
Related Toolings)
_____)

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

The claims have been amended as follows: Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

CLAIMS

1. A system for the spray forming manufacture of near net shape molds, dies and related

toolings, comprising:

a nozzle having a flow channel, said flow channel having an inlet end, an outlet end and a longitudinal axis;

a liquid reservoir in fluid communication with said nozzle flow channel, said reservoir ~~containing~~ adapted to contain a liquid material capable of forming a mold, said liquid being pressurized in a pressurized reservoir and injected from said reservoir through a conduit ending in said nozzle flow channel between said inlet and outlet ends and proximate to said nozzle longitudinal axis;

means for flowing a high temperature atomizing gas at a flow velocity ranging from high subsonic through supersonic velocities through the nozzle flow channel from the inlet end to the outlet end to atomize the liquid injected into the flow channel into a plume of atomized droplets; ~~directed to~~



a chamber containing a quench gas, said quench gas having a controlled temperature and composition for controlling the in-flight cooling of the atomized droplets;

means for directing and depositing the cooled atomized droplets onto a pattern to form the mold.

2. The system of claim 1 wherein said quench gas is selected from a group consisting of nitrogen, helium, argon, oxygen, air, and combinations thereof.

3. (Amended) The system of claim 1 further comprising means for independently heating the nozzle and the reservoir.

4. (Amended) The system of claim 1 further comprising means for providing relative



movement between the nozzle and the pattern.

5. The system of claim 1 wherein a plurality of liquid materials capable of forming a mold are injected separately into the nozzle flow channel.

6. The system of claim 1 wherein the nozzle flow channel converges to a choke portion located between the inlet end and the outlet end, and diverges between the choke portion and the outlet end.

7. The system of claim 1 wherein the liquid material is injected into the nozzle flow channel proximate to the longitudinal axis between the inlet end and the choke portion of the flow channel.

8. The system of claim 1 wherein the liquid material is injected into the nozzle flow channel proximate to the longitudinal axis between the choke portion and the outlet end of the flow channel.

9. Cancelled.

10. Cancelled.

11. Cancelled.

12. Cancelled.

13. Cancelled.

14. Cancelled.

15. Cancelled.

16. The system of claim 1 wherein the means for injecting the liquid material into the nozzle flow channel is accomplished by pressurizing the liquid reservoir.

17. The system of claim 1 wherein the nozzle flow channel has a linear transverse cross-sectional geometry.

18. A system for the spray forming manufacture of near net shape molds, dies and related toolings, comprising:

a plurality of nozzles, each nozzle having a flow channel, each of said flow channels having an inlet end, an outlet end and a longitudinal axis;

a liquid reservoir in fluid communication with each of said nozzle flow channels, said reservoir ~~containing~~ adapted to contain a liquid material capable of forming a mold, said liquid being pressurized in a pressurized reservoir and injected from said reservoir through a conduit ending in said nozzle flow channel between said inlet and outlet ends and proximate to said nozzle longitudinal axis;

a high temperature atomizing gas at a flow velocity ranging from high subsonic through supersonic velocities through each of the nozzle flow channels from the inlet end to the outlet end to



atomize the liquid injected into the flow channels into a plume of atomized droplets directed to a chamber containing a quench gas, said quench gas having a controlled temperature and composition for controlling the in-flight cooling of the atomized droplets;

means for directing and depositing the cooled atomized droplets onto a pattern to form the mold.

19. (Amended) The system of claim 18 further comprising means for independently heating the nozzles and the reservoirs.

20. (Amended) The system of claim 18 further comprising means for providing relative movement between the nozzle and the pattern.

21. The system of claim 18 wherein a plurality of liquid materials capable of forming a mold are injected separately into the nozzle flow channel.

22. The system of claim 18 wherein the nozzle flow channel converges to a choke portion located between the inlet end and the outlet end, and diverges between the choke portion and the outlet end.

23. The system of claim 22 wherein the liquid material is injected into the nozzle flow channel proximate to the longitudinal axis between the inlet end and the choke portion of the flow channel.

24. The system of claim 22 wherein the liquid material is injected into the nozzle flow channel proximate to the longitudinal axis between the choke portion and the outlet end of the flow channel.

25. Cancelled.

26. Cancelled.

27. Cancelled.

28. Cancelled.

29. Cancelled.

30. Cancelled.

31. Cancelled.

32. The system of claim 18 wherein the means for injecting the liquid material into each of the nozzle flow channels is accomplished by pressurizing the liquid reservoir.

33. The system of claim 18 wherein each of the nozzle flow channels has a linear transverse cross-sectional geometry.

34. (Amended) A system for the spray forming manufacture of near net shape molds, dies and related toolings, comprising:

a nozzle having a flow channel, said flow channel having an inlet end, an outlet end, and a longitudinal axis;

a plurality of reservoirs in separate fluid communication with said nozzle flow channel, at least one of said reservoirs ~~containing a~~ adapted to contain under pressure a liquid material capable of forming a mold, ~~said liquid being pressurized in a pressurized reservoir~~ and injected from said reservoir through a conduit ending in said nozzle flow channel between said inlet and outlet ends and proximate to said nozzle longitudinal axis;

means for flowing a high temperature atomizing gas at a flow velocity ranging from high subsonic through supersonic velocities through the nozzle flow channel from the inlet end to the outlet end to atomize the liquid injected into the flow channel into a plume of atomized droplets directed to a chamber containing a quench gas, said quench gas having a controlled temperature and composition for controlling the in-flight cooling of the atomized droplets;

means for directing and depositing the cooled atomized droplets onto a pattern to form the mold.

35. The system of claim 34 wherein at least one of said plurality of reservoirs contains solid particles, said solid particles being injected into said nozzle flow channel between said inlet and outlet ends and proximate to said flow channel longitudinal axis, said injected solid particles thereby mixing with the injected liquid materials and codeposited onto a pattern to form the mold.

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